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ABSTRACT

Data on science achievement, student attitudes and educational practices in the United States and 23 other countries were collected. This data was taken from random samples of the fifth, ninth, and twelfth grade levels. This report card conveys a few of the findings of the Second IEA Science Study regarding the performance of students in the U.S. science achievement comparisons were based on the results on common multiple choice items. Specific comparisons in this document include: (1) grades five and nine science achievement; (2) U.S. advanced science students in biology, chemistry, and physics; (3) process laboratory skills; (4) sex differences; (5) school and science attitudes; and (6) teacher reports of students' opportunity to learn science. Attached is a list of monographs and studies that are being undertaken by the U.S. division of the Second International Science Study. (CW)

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INTERNATIONAL SCIENCE REPORT CARD

From the Second IEA Science Study--U.S.
Teachers College, Columbia University

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
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The Second IEA Science Study
Teachers College, Columbia University

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Willard S. Jacobson

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

This Study is based on the assumption that people around the world can learn from each other. This report card conveys a few of the findings of the Study. In the future, additional findings will be made available in more extensive reports.

Data on science achievement, student opinions, and teaching/learning practices have been collected from random samples of classes at the 5th, 9th, and 12th grade levels in the U.S. and 23 other countries. The testing in the U.S. was done in 1986. The comparisons of science achievement are based on the results on common multiple choice items.

Science achievement was measured by international tests that were based on science curriculum case studies in each country. An Analysis of Science Curricula in the United States is available.

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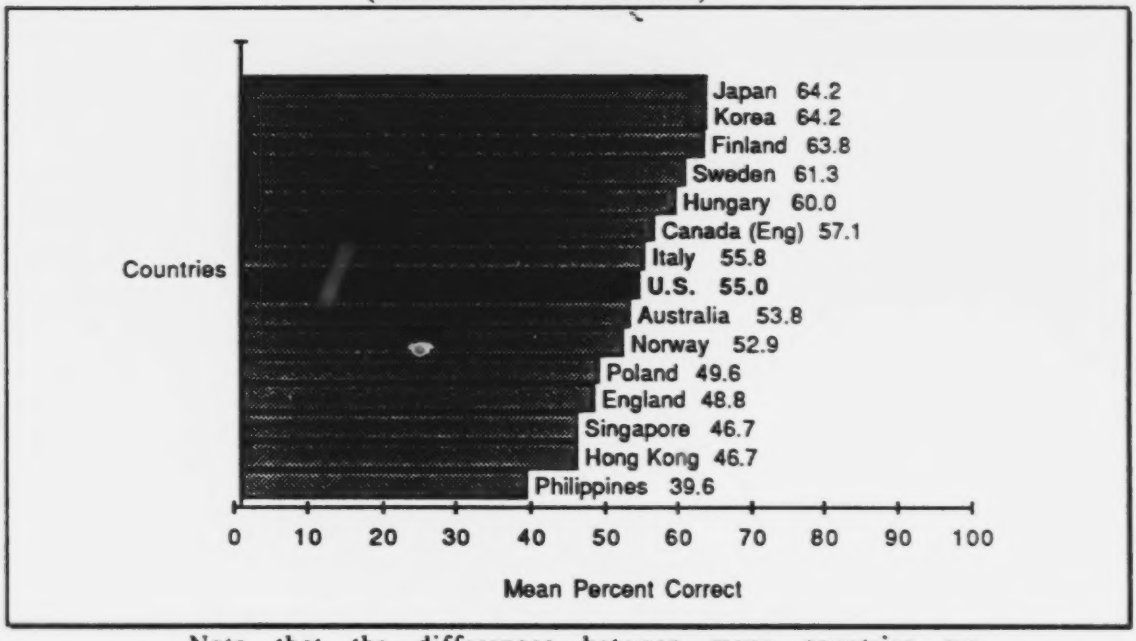
SCIENCE ACHIEVEMENT IN GRADE FIVE

On an international science achievement test, U.S. fifth grade students ranked 8th among the 15 countries whose data have been analyzed. In the U.S., 2,822 students in 123 schools responded to the science achievement tests.

Grade 5 Science Achievement in 15 Countries
(Mean Percent Correct)



Note that the differences between many countries are small. Mean scores for four countries [Canada (Eng), Italy, Australia, and Norway] are less than 2.1% from the U.S. score.

U. S. fifth grade students scored about 8% higher on physical science items than on the life sciences.

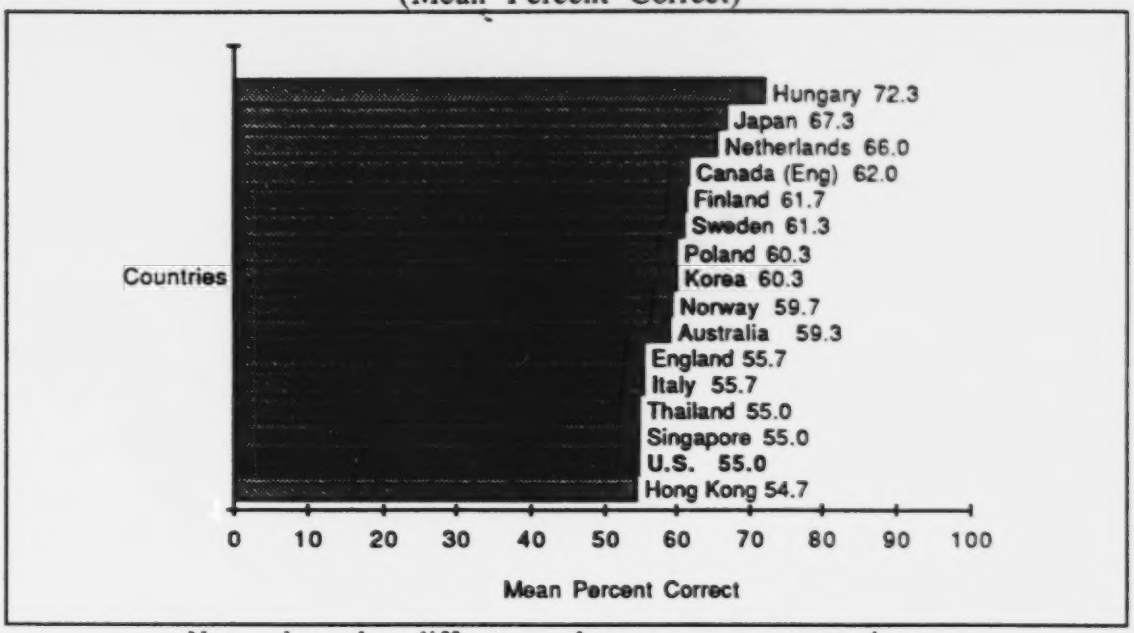
On a common set of items, U.S. students in Grade 9 scored 19% higher than students in Grade 5.

U.S. fifth grade students in 1986 performed at about the same level as did fifth grade students in 1970 on a common set of 21 items.

SCIENCE ACHIEVEMENT IN GRADE NINE

On an international science achievement test, U.S. ninth grade students ranked 15th among the 16 countries whose data have been analyzed. In the U.S., 2,519 students in 119 schools responded to the science achievement tests.

Grade 9 Science Achievement in 16 Countries
(Mean Percent Correct)



Note that the differences between many countries are small. Mean scores for six countries (England, Italy, Thailand, Singapore, Hong Kong, and the U.S.) vary by less than 1%.

U.S. ninth grade students scored 13% higher on life science items than on physical science items.

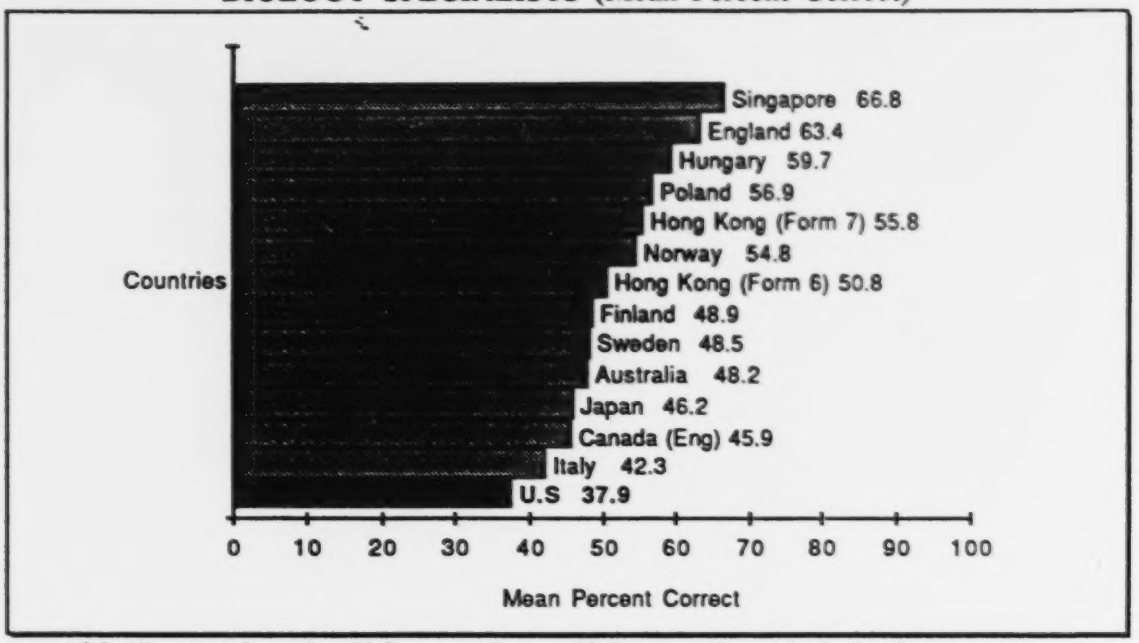
On a common set of items, U.S. students in Grade 9 scored 19% higher than students in Grade 5.

On a common set of 20 items, U.S. students in 1986 had an average score that was lower than that for ninth grade students in 1970.

U.S. ADVANCED SCIENCE STUDENTS

In 1986, U.S. students who were completing a second year of study in biology, chemistry, or physics were administered a test in their specialty area.

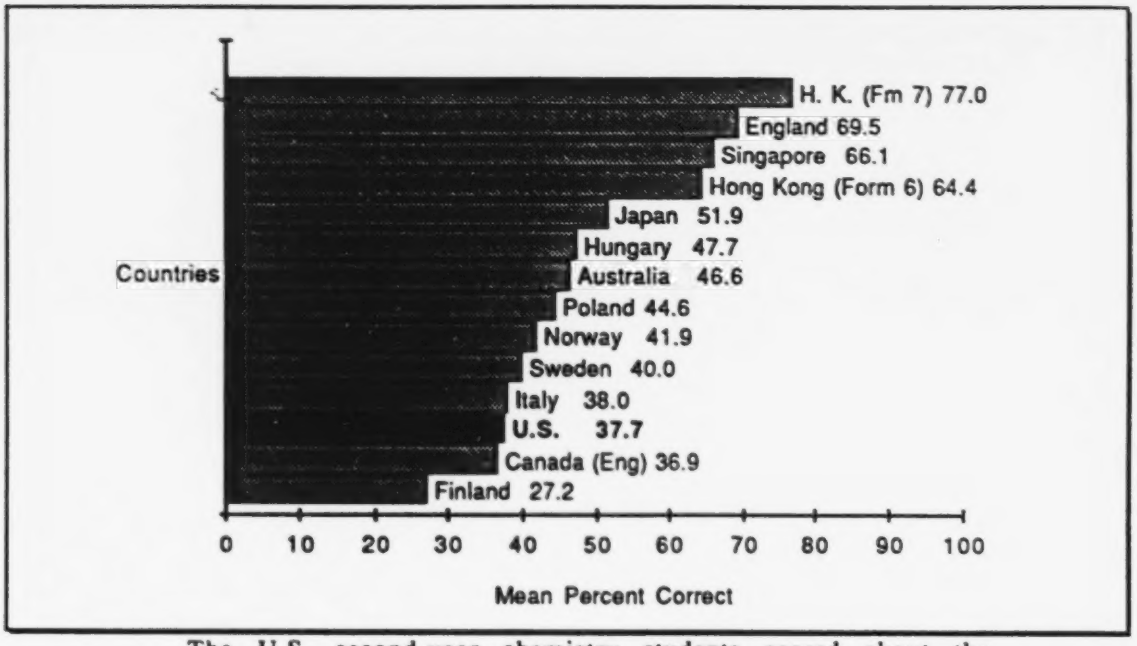
BIOLOGY SPECIALISTS (Mean Percent Correct)



Of 13 countries, the U.S. second-year biology students had the lowest score.

The results for the U.S. advanced science students who were mostly in the 12th grade and who had had two years of biology were disappointingly low. What can be done to improve the U.S. student scores in biology?

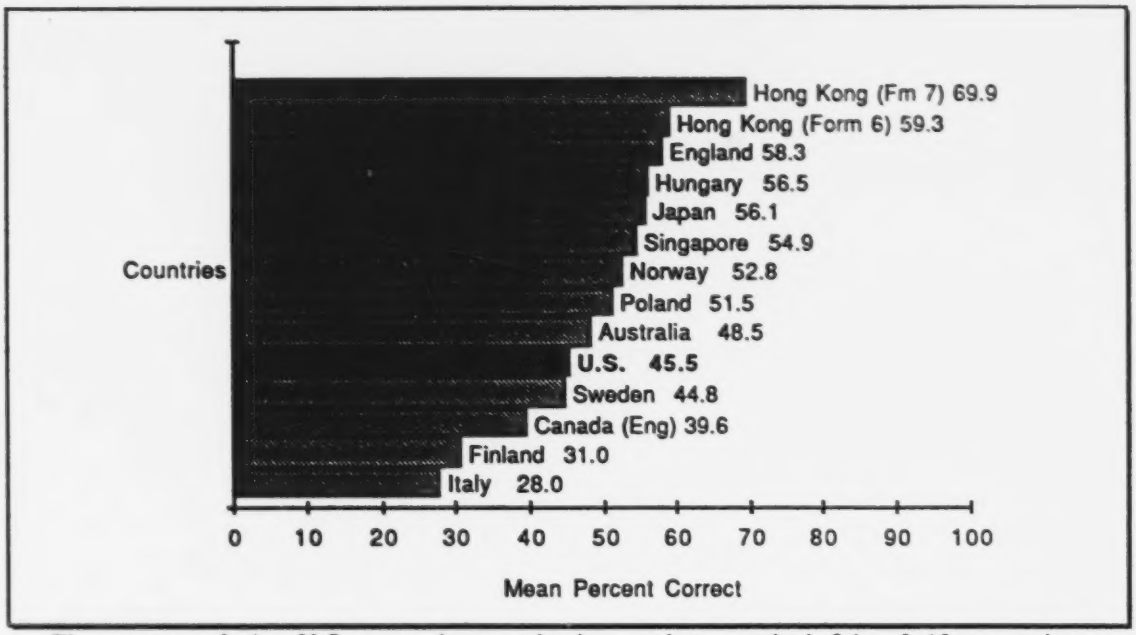
CHEMISTRY SPECIALISTS (Mean Percent Correct)



The U.S. second-year chemistry students scored about the same as students in Italy and Canada (Eng).

U.S. students who had studied two years of chemistry ranked 11th among 13 countries. What steps can be taken to raise achievement in chemistry?

PHYSICS SPECIALISTS (Mean Percent Correct)



The scores of the U.S. second-year physics students ranked 9th of 13 countries.

Most U.S. physics students study physics for the first and only time in the 12th grade. Such students were tested in 1983. It has been found that the second-year U.S. physics students tested in 1986 scored about 10% higher than the first-year physics students. Should more U.S. physics students have an opportunity to study physics for more than one year?

SCIENCE PROCESS LABORATORY SKILLS

In the spring of 1986, a sample of 2,585 fifth grade and 2,248 ninth grade U.S. students responded to an internationally designed laboratory process skills test in which they were asked to manipulate science equipment and materials, observe, measure, record data, and interpret results. These tests also were administered in Japan, Hungary, Israel, Korea, and Singapore.

U.S. students in Grades Five and Nine had scores ranging from 60% to 90% correct on tasks requiring the manipulation of apparatus, measurement of quantities, and recording of data. Students in the other countries had similar scores.

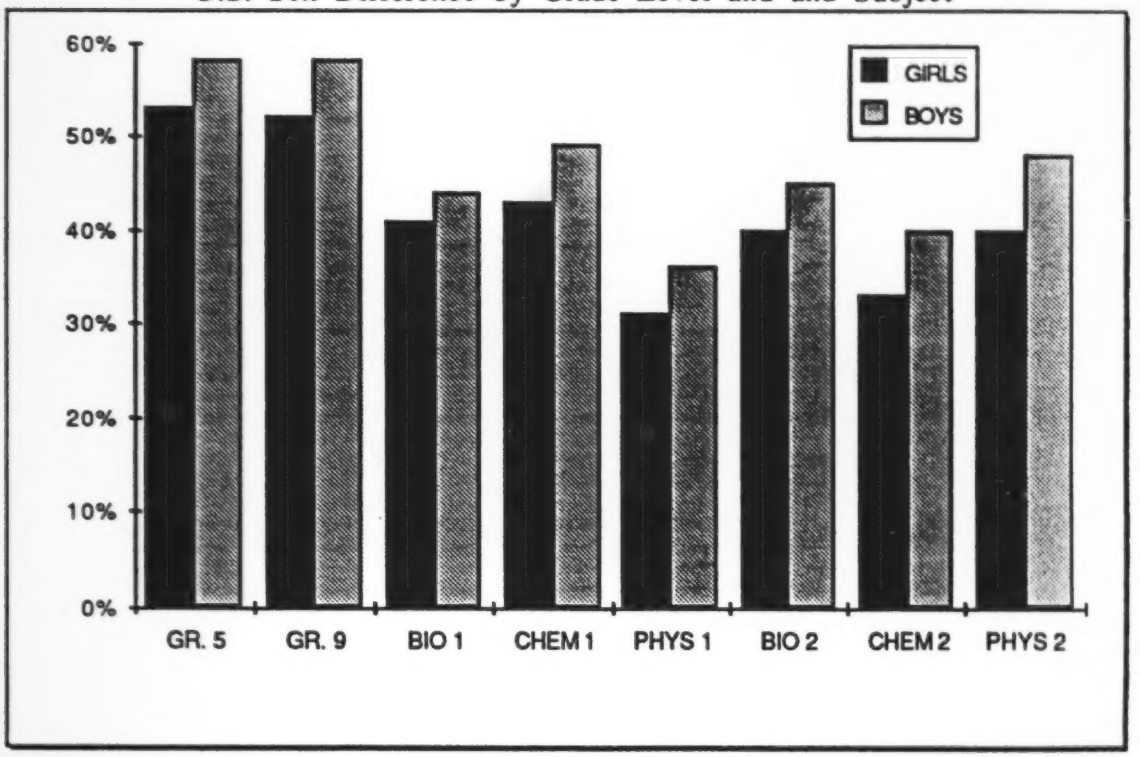
The U.S. students in Grades Five and Nine had lower scores, ranging from 7% to 62% correct, on tasks requiring the drawing of conclusions, explanations, and interpretations of findings than on "manipulative" skills. Students in the other countries had similar scores.

On these tasks, the U.S. female students earned average scores at about the same level as the U.S. male students at the Grade 5 level. At the Grade 9 level, males performed slightly better than females on science process tests. On some specific questions with life science content, females did better than males. The males outperformed the females on some questions with a physical science content.

MALE - FEMALE DIFFERENCES

In Grades 5 and 9 in all countries reporting, boys had higher scores than girls. In Grade 12 in biology, chemistry, and physics, boys had higher scores than girls except in biology in Australia, Hong Kong (Form 7) and Sweden.

U.S. Sex Difference by Grade Level and and Subject



In the U.S. at all grade levels and subjects, boys had higher science achievement than girls.

Female students in secondary schools who were taught science by male teachers performed better than those taught by female teachers.

ATTITUDES TOWARD SCIENCE AND SCHOOL

In general, U.S. students had positive attitudes toward science and school.

	Science is Important for a Country's Development	Science is an Enjoyable Subject	Science as Taught in School is Interesting
Grade 5	79%	71%	72%
Grade 9	80%	52%	53%
Grade 10 Biology (U.S. only)	81%	44%	52%
Grade 11 Chemistry (U.S. only)	91%	47%	52%
Grade 12 Advanced Biology	92%	65%	68%
Grade 12 Advanced Chemistry	94%	76%	72%
Grade 12 Advanced Physics	96%	80%	75%

A large majority of the students at all levels and each subject believe that science is important for national development.

Grade 5 students and advanced science students found science enjoyable and interesting.

Students in Grade 9, Grade 10 biology, and Grade 11 chemistry did not find their science studies as enjoyable and interesting.

THE OPPORTUNITY TO LEARN

The school factor most strongly correlated with achievement in science was the "opportunity to learn."

Teachers were asked to indicate whether the students had had an opportunity to learn the science concepts tested by each question.

The following are the percentages of items that teachers report students have had opportunity to learn this year or this year and previous years.

	This Year's Science Course	This Year's or a Previous Year's Science Course
Grade 5	42%	64%
Grade 9	35%	60%
Grade 10 Biology (U.S. only)	68%	78%
Grade 11 Chemistry (U.S. only)	74%	80%
Grade 12 Advanced Biology	42%	79%
Grade 12 Advanced Chemistry	42%	81%
Grade 12 Advanced Physics	53%	88%

COOPERATION

Over 20 thousand students and more than one thousand teachers gave the time and effort to complete the tests and reply to questionnaires.

Available to You

The tests that were used and both the U.S. and the International results will be made available. You can use the tests in your school. How do your students' scores compare with the national and international results?

If you want more information, request Second International Science Study (SISS) reports from the:

National Science Teachers Association
1742 Connecticut Avenue, N.W.
Washington, DC 20009

SISS MONOGRAPHS AND STUDIES

The following is a list of the monographs and studies that are being undertaken in SISS--U.S.:

Science Education in the United States and Other Countries (A Report to the Public)*
Willard J. Jacobson and Rodney L. Doran

International Science Report Card**

The Second IEA Science Study--U.S., Revised Edition**
Willard J. Jacobson, Rodney L. Doran, Edith Y.T. Chang, and Eve Humrich

Science Achievement in the United States*
Willard J. Jacobson, Rodney L. Doran
Eugene W. Muller, and Mark Rinkerman

An Analysis of Science Curricula in the United States**
June K. Miller

The Teaching and Learning of Biology in the United States*
O. Roger Anderson

The Teaching and Learning of Chemistry in the United States*
Joseph Menis

The Teaching and Learning of Physics in the United States**
Marilda S. Chandavarkar

The Teaching and Learning of Elementary School Science
Elizabeth A. Meng

The Teaching and Learning of Science at the Ninth Grade Level
James Micik

Correlates of Science Achievement: A U.S. Study of Fifth Grade Students**
Ethelbert Ekeocha

Science Achievement of Advanced Science Students*
Arleene Cervasio

** Essentially Completed
* Underway

Science Achievement of Students not Studying Science*
Joan Jung

Science Process Laboratory Skills*
Ira Kanis

Science Education in the 1970s and 1980s: What Changes have Taken Place?**
Edith Y. T. Chang

Sex and Achievement in Science**
Eve Humrich

Mathematics and Science Education
Eileen Donoghue

Science Achievement in the United States and in Other Countries: What can be Learned from Other Countries?
Kevin J. Bleakley

Science Achievement of Non-Science Students--A Case Study*
Roosevelt J. Baker

Science Achievement in an American School-- A Case Study**
James M. Micik

Achievement in Science Education in the United States: Student, Teacher, School, and Community Factors that Correlate with Science Achievement*
Steven L. Beyer

Modeling Classroom Environments: An Analysis of Achievement at the Ninth Grade Level**
Michael A. Dryden

The Trial Testing of Items and Instruments for the Second IEA Science Study: An Analysis of Results to Verify the Cumulative Hierarchical Nature of Bloom's Taxonomy of Educational Objectives (Cognitive Domain)**
Thelma Clive

Science Curricula and Achievement in Science
June K. Miller

Science Achievement in Japan and the United States**
Willard J. Jacobson, Shigekazu Takemura, Rodney L. Doran, Shigeo Kojima, Eve Humrich, and Masao Miyake